

## **Appendix N**

### **Civil Support Team Decontamination Operations**

Decontamination is the reduction or removal of CBR contamination from persons and equipment by physical and/or chemical processes. Emergency response and CST personnel independently or collectively can implement thorough and/or emergency decontamination and verification procedures to ensure contamination is not spread to cold-zone operations. The CST commander will appoint an officer in charge/ noncommissioned officer in charge (OIC/NCOIC) for the decontamination line, which should be manned by two to four individuals, as the situation warrants. All contaminated equipment will be decontaminated before leaving the site, or will be properly packaged for disposal. The degree of decontamination and appropriateness of the packaging will be agreed to by the CST commander and the IC. The CST decontamination site is established to remove and localize CBR contamination from team members, exteriors of the CBRNE sample containers, detection and identification equipment, and decontamination-site equipment. The primary objective for personnel manning the decontamination station is to avoid becoming contaminated or contaminating other personnel or equipment outside the hot-zone. If contamination is suspected, decontamination of personnel, equipment, and apparatus should be performed. The decision to implement all or part of a decontamination plan should be based upon a field analysis of the hazards and risks involved. This analysis generally consists of referring to technical reference sources to determine the general hazards (such as reactivity, flammability, and toxicity), and then evaluating the relative risks.

#### **DECONTAMINATION PLANNING**

N-1. During every incident involving a CBRNE release, there is a possibility that targeted personnel, members of the public, clothing, and equipment will become contaminated. The contaminant poses a threat not only to the persons contaminated, but also to other personnel who may subsequently encounter contaminated personnel and equipment. The entire process of decontamination should be directed toward confinement of the contaminant within the hot-zone and the decontamination corridor to maintain the safety and health of response personnel, the public, and the surrounding environment.

N-2. Although decontamination is typically performed following site entry, the determination of proper decontamination methods and procedures must be considered before and during the incident as part of the overall incident planning and hazard and risk evaluation process. Entry into the hot-zone

should not be attempted until appropriate decontamination methods are determined and established based on the hazards present.

N-3. Before initiating decontamination, the following questions should be considered:

- Can decontamination be conducted safely (visibility, access, waste management)?
- Are existing resources adequate and immediately available to perform decontamination of personnel and equipment? If not, where can they be obtained and how long will it take to get them?
- What are the agents to be decontaminated?
- What are the existing and forecast meteorological conditions (wind direction and speed, temperature, etc.)?
- What is the terrain?

N-4. Physical methods generally involve the physical removal of the contaminant from the contaminated person or object and containment of the contaminant for appropriate disposal. Physical removal is the most important principal in decontamination. While these methods can reduce the concentration of the contaminant, generally the chemical properties are unchanged. Examples of physical decontamination methods include the following:

- Absorption.
- Brushing and scraping.
- Isolation and disposal.
- Washing.

N-5. Chemical methods are used on equipment and generally involve decontamination by changing the contaminant through some type of chemical reaction to render the contaminant less harmful. Chemical methods destroy or inactivate the agent. Examples of chemical methods include the following:

- Adsorption.
- Chemical degradation.
- Disinfecting or sterilization.
- Neutralization.
- Solidification.

N-6. If contact with a contaminant can be controlled, the risk of exposure is reduced and the need for decontamination can be minimized. The following actions should be considered to prevent contamination:

- Stress work practices that minimize contact with hazardous substances.
- Wear limited-use or disposable protective clothing and equipment where appropriate military traffic management systems exist.

## DECONTAMINATING PERSONAL PROTECTIVE EQUIPMENT

N-7. During the doffing of PPE, clothing and equipment should be removed in a manner so that the outer surfaces do not touch or make contact with the wearer's skin. The CST survey team leader should require team members to maintain a log of PPE used during all hazard identification and sample collection operations. Military and/or first responder personnel wearing disposable PPE should proceed through the decontamination process after removing equipment harnesses and externally mounted cameras and placing weapons in authorized storage containers. Disposable protective equipment is containerized and identified for HAZMAT disposal in accordance with established procedures. Personnel undergoing decontamination are monitored for contamination prior to crossing the liquid control line. The physical and chemical compatibility of decontamination solutions needs to be determined before they are used. Any decontamination method that permeates, degrades, damages, or otherwise impairs the safe function of PPE and endangers the wearer should not be used.

N-8. Water or other solutions for washing or rinsing have to be confined, collected, and containerized for proper disposal. CST command and operations sections will need to establish liaison with on-scene environmental and public health agencies to coordinate hazardous wastes containerization and disposal methods.

N-9. Decontamination methods vary in their effectiveness for removing different substances. If decontamination does not appear to be effective, a different method should be selected and implemented. Determining the effectiveness of decontamination during field operations includes the following:

- Contamination levels are reduced as personnel move through the decontamination corridor.
- Contamination is confined to the hot-zone prior to the vapor control line of the decontamination corridor.
- Contamination is reduced to a level that is as low as reasonably achievable (ALARA).

N-10. Methods that may be useful in assessing the effectiveness of decontamination include—

- Visual observation (stains, discolorations, corrosive effects).
- Monitoring devices (such as PIDs, chemical agent monitor [CAM], radiac meter detector tubes, and pH paper strips) can show that contamination levels are at least below the detection limit.
- Wipe sampling provides after-the-fact information on the effectiveness of decontamination. Once a wipe swab is taken, it is analyzed by chemical means, usually in a laboratory. Protective clothing, equipment, and skin may be tested using wipe samples.

N-11. Personnel assigned to the decontamination team wear an appropriate level of PPE. PPE can be upgraded or downgraded as additional information is obtained concerning the type of HAZMATs involved, the degree of hazard, and the probability of exposure of CST personnel.

N-12. If personnel display any symptoms of heat exhaustion/hypothermia or CBRNE exposure, implement immediate measures to doff PPE while protecting the individual from contaminants and preventing the spread of any contaminants. These individuals will be treated immediately by the CST medical personnel.

N-13. Exposed persons should be provided with as much information as possible about the delayed health effects of the HAZMATs involved in the incident. If necessary, follow-up examinations should be scheduled with medical personnel. Medical and exposure records will be updated as soon as the mission allows.

## DECONTAMINATION PROCESS

N-14. The decontamination process is carried out in three fundamental stages:

- **Primary.** Gross contamination removal.
- **Secondary.** Residual contamination removal.
- **Tertiary.** PPE removal and personal shower.

N-15. A liquid control line and a vapor control line separate these stages from the hot-zone to the cold-zone. The decontamination site sequential actions should be—

- Equipment drop.
- Outer suit scrub and rinse.
- Initial monitoring.
- Outer garment removal.
- Air supply removal.
- Mask (faceplate) removal.
- Personal shower.
- Medical monitoring.

N-16. The decontamination procedures for all levels of protection generally consist of 19 steps (see Table N-1). Each step emphasizes an important aspect of decontamination.

N-17. Decontamination lines are site-specific and vary depending on the types of contamination and the work activities conducted on-site.

N-18. The objective of decontamination procedures is to minimize the risk of exposure to hazardous substances in the field. Personnel must wear protective equipment when response activities involve known or suspected hazardous substances.

**Table N-1. Decontamination Steps (Example Template)**

<b>Step</b>	<b>Description</b>	<b>Procedure</b>
<b>1</b>	Segregated Equipment Drop	Deposit equipment used on site (tools, sampling devices and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths or in different containers with plastic liners. During hot-weather operations, a cool-down station may be set up within this area.
<b>2</b>	Boot Cover and Glove Wash	Scrub outer boot covers and gloves with decontamination solution or detergent and water.
<b>3</b>	Boot Cover and Glove Rinse	Rinse decontamination solution from step 2 using copious amounts of water.
<b>4</b>	Tape Removal	Remove the tape around boots and gloves and deposit it in a container with a plastic liner.
<b>5</b>	Boot Cover Removal	Remove boot covers, and deposit them in a container with a plastic liner.
<b>6</b>	Outer Glove Removal	Remove outer gloves, and deposit them in a container with plastic liner.
<b>7</b>	Suit and Boot Wash	Wash encapsulating suit and boots with a scrub brush and decontamination solution or detergent and water. Repeat as many times as necessary.
<b>8</b>	Suit and Boot Rinse	Rinse off decontamination solution with water. Repeat as many times as necessary.
<b>9</b>	Tank Change	Change the air tank if needed (the last step in the decontamination procedure). Exchange air tank, don new outer gloves and boot covers, and tape joints. The worker returns to duty.
<b>10</b>	Safety Boot Removal	Remove safety boots, and deposit them in a container with a plastic liner.
<b>11</b>	Fully Encapsulating Suit and Hard Hat Removal	Remove the fully encapsulated suit with the assistance of a helper, and lay it on a drop cloth or hang it up. Remove the helmet. Hot-weather rest station may be set up within this area for personnel returning to the site.
<b>12</b>	SCBA Backpack Removal	Remove the backpack, and place it on the table while wearing the face-piece. Disconnect the hose from the regulator valve, and proceed to the next station.
<b>13</b>	Inner Glove Wash	Wash with decontamination solution that will not harm the skin. Repeat as often as necessary.
<b>14</b>	Inner Glove Rinse	Rinse with water, and repeat as many times as necessary.
<b>15</b>	Face Piece Removal	Remove the facepiece. Deposit it in a container with a plastic liner. Avoid touching your face with your fingers.
<b>16</b>	Inner Glove Removal	Remove inner gloves and deposit them in a container with a plastic liner.
<b>17</b>	Inner Clothing Removal	Remove clothing, and place it in a container with a plastic-liner. Do not wear inner clothing off the site since there is a possibility that small amounts of contaminants might have been transferred in removing the fully encapsulating suit.
<b>18</b>	Field Wash	Shower if highly toxic, skin-corrosive, or skin-abrasive materials are known or suspected to be present. Wash your hands and face if a shower is not available.
<b>19</b>	Redress	Put on a clean uniform.

## CASUALTY DECONTAMINATION

N-19. The CST can provide advice on casualty decontamination (see Table N-2). The CST is not designed or equipped to perform mass casualty decontamination. Normally, a contaminated casualty should not be placed in an ambulance or taken into a medical treatment facility (MTF) without first removing his clothing and processing him through a decontaminating station. Eighty percent of decontamination is accomplished by the removal of clothing. While removing clothing accomplishes partial decontamination of contaminated casualties, complete decontamination will require clothing removal (strip) and bathing with soap and water (flush). Wrap the casualty in a sheet or protective cover to protect him from the elements and possible recontamination (cover). Casualty decontamination considerations include the following:

- Decontamination will not be limited to the incident scene.
- Casualties should be provided containers (clear zipperlock plastic bags) for their valuables (watches, wallets).
- Some casualties may be uncooperative and resist decontamination or separation from family members. However, decontamination must be completed even if the individual must be restrained in order to complete the process.

**Table N-2. Casualty Decontamination Considerations**

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| <ul style="list-style-type: none"><li>• Protect yourself and your fellow responders first.</li><li>• Save lives by rapid decontamination.</li><li>• Provide adequate staffing (can use nonmedical personnel for this task).</li><li>• Prevent heat-related stress injuries for personnel in PPE.</li></ul> |
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N-20. The best method of determining completeness of decontamination for a patient is through direct monitoring with the appropriate detection device. Direct observation of individuals (symptoms, colored or oily spot) who have completed the decontamination process enhances the verification that personnel are clean and will not transfer contamination outside of the incident site. Do not totally rely on the use of one verification method to certify that casualties are “clean.”

## SITE LOCATION AND LAYOUT

N-21. Establish decontamination sites upwind and uphill from the incident. Areas should be flat and protected from public and media intrusion and should allow containment of decontamination runoff. If personnel and equipment allow, there may be four decontamination lines—

- Ambulatory casualties, asymptomatic.
- Ambulatory casualties, symptomatic.
- Litter casualties.
- Responders (this is known as technical decontamination).

N-22. Whenever possible, ambulatory and litter casualty decontamination lines should be located close to one another so that EMS personnel can easily monitor multiple lines. The technical decontamination line should be isolated from the other lines and monitored by medical personnel to assist responders if necessary. All responders working in the decontamination area must have the proper training and PPE. To avoid cross contamination, ensure that workers do not cross the dividing line between clean and dirty areas.

## MASS CASUALTY DECONTAMINATION

N-23. At the CBRNE incident site, a large number of contaminated casualties can be showered (cleaned) using a combination of ingenuity and current technologies. Examples include using mobile trailers designed for mass decontamination, portable showers, and collection pools. Also, set up long hoses in corridors to provide a fine spray corridors for victims to walk through. Use a deck gun with a wide-angle, low-pressure, fog spray to rinse as many people as possible simultaneously. Fire hose streams must be used with care to avoid injuries. Soap is needed to remove some agents.

**NOTE: Soap and water do not neutralize or destroy CBRN agents or TIM; they only remove them. The agent is potentially still viable and can cause injury or disease in others exposed to the soap and water solution containing the agent.**

## DECONTAMINATION PROCEDURES FOR AMBULATORY CASUALTIES

N-24. Ambulatory casualties require no assistance and have few or no symptoms. Some of these casualties may need to shower sitting on a chair and/or may require additional supervision. Personnel performing casualty decontamination need to don appropriate PPE before making casualty contact. (Use the buddy system to don PPE.) EMT and other medical personnel performing initial triage in the warm zone will also need to don PPE. The IC should establish an initial triage area to enable EMT personnel to evaluate and assist casualties. Use the following steps:

**Step 1.** Instruct the casualty to remove all clothing, jewelry, and personal belongings. These items should be placed in appropriate containers, using plastic bags with labels for identification.

**Step 2.** Instruct casualty who is disrobing that outside clothing should not touch inside clothing to avoid additional contamination. If biological agents are suspected, a fine water mist can be applied to trap the agent in the clothing and prevent the spread of contamination (chemical agent must be ruled out before using this technique to prevent the spread of the agent over body areas).

**Step 3.** Direct casualty to the appropriate decontamination station (wash, rinse, etc).

**NOTE: Ensure that the shower water is turned on, and instruct casualties to enter the shower and wash their entire body (head to toe). Each casualty should be directed to use soap and water or 0.5percent high-test hypochlorite (HTH) solution with sponges for 3 to 5-minutes, and then rinse. Prepare the 0.5 percent hypochlorite solution as shown in Table N-3.**

**CAUTION**

Ensure that the HTH solution never enters the eyes, nose, or open abdominal, thoracic, or head wounds.

**Table N-3. Prepare a Hypochlorite Solution**

Water (Ounces)	OR	Granular HTH (Spoonfuls)	Household Bleach (Quarts)	HTH Solution Percentage in 5 Gallons of Water
6		*5	2	0.5%
48		40	**	5.0%
*These measurements are used when bulk HTH is used. To measure this preparation, use the plastic spoon supplied with your MRE. The amount of HTH to be used is a heaping spoonful (that is, all that the spoon will hold). Do not shake any granules off the spoon before adding to the water. ** Do not dilute with water; household bleach is approximately a 5% solution.				

**Step 4.** Instruct casualty to pay attention to his groin, folds in the skin, and nails and to close his mouths and eyes during the decontamination procedure.

**Step 5.** Instruct the casualty to step out of the shower, and provide him a towel that should be disposed of appropriately.

**Step 6.** Reevaluate the casualty to determine the need for a second shower. Use gross-level chemical detectors or Geiger-type counters for remaining chemical or radiological contamination; no method exists for speedy detection of biological agents.

**Step 7.** Provide personnel who do not require additional showers with clothing and foot covers and direct them to a clean area for medical evaluation or evacuation. If no portable showers are available, first responders can use a fire hose with a fog nozzle and portable monitors.

**DECONTAMINATION PROCEDURES FOR NONAMBULATORY CASUALTIES**

N-25. Nonambulatory casualties are unable to sit or stand unattended. This line will require more time and personnel support than the ambulatory casualty line. Steps can include the following:

**Step 1.** Don appropriate PPE before making casualty contact. (Use the buddy system to don PPE.) Establish an initial triage point to evaluate and direct casualties.

**Step 2.** Perform lifesaving intervention.

**Step 3.** Remove all clothing, jewelry, and personal belongings; and place in their appropriate containers. Decontaminate as required, and safeguard. Use clear plastic bags with labels for identification.

**Step 4.** Carefully undress nonambulatory casualties, avoid spreading the contamination when undressing. Do not touch the outside of the clothing to the skin. If biological agents are suspected, a fine water mist can be

applied to trap the agent in the clothing and prevent the spread of contamination.

**Step 5.** Decontaminate splints in place to prevent bone displacement. Do not remove bandages where possible until after the decontamination process has been completed. Avoid additional bleeding if possible.

**Step 6.** Flush deep wounds with saline solution, and superficial, soft tissue wounds with a 0.5 percent hypochlorite solution.

#### CAUTION

Ensure that HTH solution is never introduced into the eyes, nose, or open abdominal, thoracic, or head wounds.

**Step 7.** Transfer the casualty to the nonambulatory wash area of the decontamination station on an appropriate backboard/litter device (can be two sawhorses, an elevation grid, a stationary roller system, or another device).

**Step 8.** Completely wash the casualty's entire body using handheld hoses, sponges, and/or brushes (soap and water or a 0.5 percent hypochlorite solution should be used for 3 to 5 minutes to decontaminate the casualty), and then rinse.

**Step 9.** Clean the casualty's groin, folds in the skin, and nails with special attention. Instruct casualty to close his mouth and eyes during wash and rinse procedures. Hot water may be unnecessary unless casualty hypothermia during decontamination is a concern.

**Step 10.** Transfer the casualty from the wash and rinse stations to a drying station after completing the decontamination process. Ensure that the casualty is completely dry, and monitor him for additional contamination using the appropriate detection device.

**Step 11.** Reevaluate the casualty's injuries (on-scene medical personnel).

**Step 12.** Transfer nonambulatory casualties to a clean ambulance for evacuation (personnel from the clean-zone).

## DECONTAMINATION CLEANUP

N-26. The cleanup process is important to reduce the spread of contamination. Procedures for decontamination site cleanup include the following—

- Containerize casualty clothing, bandages, consumable medical items, paper and plastic items, nonreusable equipment, and used water.
- Label the waste containers and placing them in the center of the area used for decontamination.
- Advise the CST OPCEN that decontamination site cleanup has been completed and that coordination with the IC is required for appropriate disposal of contaminants.